Sharif University of Technology
Department of Computer Engineering

CE 693: Advanced Computer Networks

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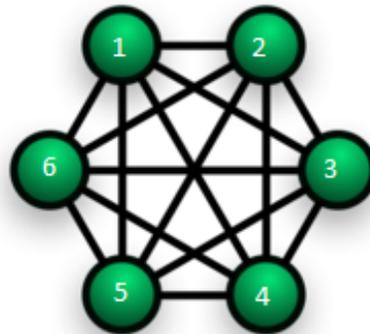
Homework 1

Please email your answer/report in **PDF format** to Mr. Baki "baki@ce.sharif.edu" and CC me at "kharrazi@sharif.edu". The HW file name should be **"Your Lastname-693-HW-1"**. It should be used as the subject of your email, too. In order for us not to miss your homework please follow the formatting. This homework is due by **Mehr 18th, 11:59 PM**. You are also supposed to have a face-to-face delivery, the time of which will be announced later.

Part I

Answer the following questions in detail.

1. There were a number of networks using packet switching before the current Internet, ARPANET and CIGALE are two examples. The former works with the speed of 200 Kbps and the later with 48 Kbps.

   (a) Briefly describe the switching techniques which were utilized in each (datagram or virtual circuit). What was the motivation in each case?

   (b) Compare transmission time of a file in ARPANET and CIGALE. Assume a file with $M * L$ size (M packets each with L bytes) and use parameters for other value(s) as you may need.

   (c) Can the result of previous section be used to compare the transmission time of datagram and virtual circuit based networks? Conduct the comparison carefully. If you need additional assumption note it in your answer.

   (d) You should analyze transmission time for data with the same size ($M * L$) in a telephony network and compare it with previous results. Do you have an estimation about the real value of connection establishment time?

2. For this question, assume a network with the following topology in which each circle shows a router.

(a) Each sent routing message takes t seconds per hop. Assuming nodes are running OSPF, how long it takes for an arbitrary node's routing table to converge? How about the RIP?

(b) Fill in the routing table of a node with OSPF and RIP, after convergence. Are these protocols scalable?

(c) Can OSPF/RIP routers find routing loops? Try to describe pointing to figure.

(d) What if a node failure occurs? How much changes are required in routing tables in case of each protocol?

(e) Do you think that routing protocols should work over TCP?

3. Answer the following questions about the TCP.

(a) Is it possible for the network's actual RTT to become larger than the RTO? Why/Why not? What is the result of this possibility/impossibility on time out occurrence?

(b) Which one is more potent to unnecessary time outs? Small windows or big ones?

(c) Analyze the behavior of TCP in HTTP connections and the motivation for *Persistent HTTP*.

Part II [1]

Unix/Linux provides a series of useful utilities to configure, analyze, and debug networks. This section is designed for you to gain an understanding of what these tools are and what you can use them for. You should find commands and execute them from an *Unix/Linux* machine in order to answer the following questions. Also give a brief description about used commands.

1. What are your IP address and MAC address?

2. What are the IP address and MAC address of your Gateway?

3. How long is the RTT of your path to your gateway? Compare it with an arbitrary website's RTT.

4. Change your default gateway to an invalid IP address. Thus you will loose your internet connection. Then, add a new route towards 4.2.2.4 through your previous default gateway. Verify that your access to this IP address is restored (**Note: Use the *ip* command**).

5. Change your MAC address. Is there any limitation in its values? Why?

6. Send an arbitrary file through a TCP connection between two hosts (**Note: Use the *nc* command**).

7. Write a simple script to find your public IP address, the organization which your IP address belongs to, and its AS number (**Note: Use websites reporting your public IP address and parse them in your script to get your public IP address**).

Part III

In this part of the assignment, the goal is to become familiar with network traces and be able to write simple scripts to process such data. Please follow the below steps.

- Get familiar with a sniffing program such as *tcpdump* (found on most *nix distributions), specially with the filtering options for data collection.

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[1]Obtained from an assignment given in CS744 computer networks at Carnegie Mellon by Srinivasan Seshan.

- While connected through an Ethernet connection, download a file from the web, and collect the network traffic. You should make this download from a server with low RTT values.

- While connected through an Ethernet connection, download a file from the web, and collect the network traffic. You should make this download from a server with high RTT values. (Perhaps downloading a file from New Zealand, Australia, South America, etc ....)

Locate the TCP stream for the file you downloaded, and obtain the following information from that TCP stream. To answer some of the below questions, you should write simple scripts with perl, python, or the scripting language of your choice and for others just a write a simple command.

1. What are the source and destination ports?

2. What ISN is used from your side (i.e. the client)? what about ISN of server?

3. What is the total number of packets sent and received?

4. What is the window size advertised by the receiver?

5. Did you observe any fragmented packets? Report on them.

6. Do you observe any packet losses? How about retransmissions? Report on them.

7. Find DNS query reply packets. Which domain names are resolved to which IP addresses

8. Plot the congestion window for the connection as a function of time. How accurate is your plot?